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METHODS FOR DETERMINATION OF
WOOL FIBRE CONTENT OF RAW WOOL

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard

METHODS FOR DETERMINATION OF WOOL FIBRE CONTENT OF RAW WOOL

(Revised)

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Indian Standard

METHODS FOR DETERMINATION OF WOOL FIBRE CONTENT OF RAW WOOL

(Revised)

0. FOREWORD

0.1 This revised Indian Standard was adopted by the Indian Standards Institution on 13 March 1964, after the draft finalized by the Textile Standards Sectional Committee had been approved by the Textile Division Council.

0.2 Raw wool, that is, wool as shorn from the sheep or wool which is pulled, limed or ginned and carded, contains varying amount of impurities like sand, grease, suint, vegetable matter, tags and dung. It is, therefore, purchased on the basis of either laboratory scoured yield or clean wool fibre content. Formulation of an Indian Standard for determining the laboratory scoured yield and clean wool fibre content of raw wool has, therefore, become necessary.

0.3 This standard was first published in 1959. It was pointed out that, for a given raw wool, the value for clean wool yield obtained on the basis of the method prescribed in this standard differed from those obtained by some of the laboratories abroad. The Committee, on examining this matter in great detail, found that such differences were due to the differences in the nomenclature and the definition of the term used to indicate the clean wool fibre content in raw wool; in the earlier edition the term 'clean wool yield' was used in the sense of clean wool fibre content. The Committee, therefore, decided to prepare this revision including and defining the terms 'laboratory scoured yield' and 'clean wool fibre content' explicitly. This opportunity has been taken to change the sampling procedure so as to recognize the drawing of samples only from press-packed bales. Further changes have been incorporated in respect of reagents. In this revision, the determination of vegetable matter content has been made obligatory irrespective of whether the wool under test purports to be a 'burry wool' or 'non-burry wool' and consequently reference to 'burry' and 'non-burry' wool is omitted.

0.4 In preparing this standard, considerable assistance has been derived from:

BARKER, S. G. Wool Quality. London. H. M. Stationery Office, 1931.

THOMPSON, T. E. The Scouring of Raw Wool. Manchester. Emmott & Co. Limited, 1948.

ASTM Designation: D 584-57 METHODS OF TEST FOR WOOL CONTENT OF RAW WOOL (LABORATORY SCALE). American Society for Testing and Materials.

0.5 Wherever a reference to any Indian Standard appears in these methods, it shall be taken as a reference to the latest version of the standard.

0.6 Metric system has been adopted in India. Therefore, all quantities and dimensions in this standard have been expressed in this system.

0.7 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960 Rules for Rounding Off Numerical Values (*Revised*).

1. SCOPE

1.1 This standard prescribes methods for determination of clean wool fibre content (*see 2.1*) and laboratory scoured yield (*see 2.2*) of raw wool.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Clean Wool Fibre Content — The weight of wool fibres, free from vegetable matter, grease, dirt and other impurities and adjusted to the standard condition of 13.8 percent moisture content, 1.5 percent alcohol extractable matter content and 0.5 percent ash content, the latter two calculated on the basis of the oven-dry weight of the scoured specimen.

2.2 Laboratory Scoured Yield — The total weight of wool fibres and vegetable matter free from grease, dirt and other impurities and adjusted to the standard condition of 13.8 percent moisture content, 1.5 percent alcohol extractable matter content and 0.5 percent ash content, the

latter two calculated on the basis of the oven-dry weight of the scoured specimen.

2.3 Lot — The quantity of raw wool drawn from one definite type of package purporting to be of one definite colour and quality delivered to one buyer against one despatch note.

2.4 Vegetable Matter — Burrs, seeds, twigs, leaves and grasses that may be present in the sample of raw wool. Vegetable matter does not include vegetable fibres or tag material that may be present in the sample of raw wool.

3. SAMPLING

3.1 Sample to evaluate the laboratory scoured yield and clean wool fibre content of raw wool in a lot shall be selected so as to be representative of the lot.

3.2 Sample to evaluate the laboratory scoured yield and clean wool fibre content of raw wool in a lot, selected in compliance with an agreement between the buyer and the seller, shall be held to be representative of the lot.

3.3 If there is no agreed method of drawing a test sample, the number of bales to be selected at random from the lot shall be as specified in Table I. All the bales so selected shall, taken together, constitute the bulk sample.

**TABLE I NUMBER OF BALES TO BE SELECTED AT
RANDOM FROM A LOT**

NO. OF BALES IN A LOT	NO. OF BALES TO BE TAKEN
9 or less	All
10 to 30	10
31 „ 60	15
61 „ 100	20

NOTE — Lots consisting of more than hundred bales, shall be divided into smaller lots each consisting of 100-bales and the remaining bales, if any, as one lot.

3.3.1 With the help of a sampling tool (*see* Note 1), draw cores conforming to the requirements of Table II from different portions of each bale in the bulk sample. Thus collect a test specimen, weighing

about 250 g, and transfer it directly from the drum of the apparatus to a moisture-proof polythene bag, which shall be immediately sealed to avoid ingress of atmospheric moisture. If facilities to weigh accurately are available, the test specimen shall be weighed before transferring it to the bag (see Note 2). Draw similarly two more test specimens. All the cores so collected shall, taken together, constitute the **gross sample**.

NOTE 1 — A 13 mm diameter tube is suitable for press packed bales.

NOTE 2 — If the test specimen is weighed, its weight shall be noted on a label affixed to the sealed container.

TABLE II NUMBER OF CORES TO BE TAKEN PER BALE

(Clause 3.3.1)

NO. OF BALES IN THE BULK SAMPLE	NO. OF CORES TO BE TAKEN PER BALE
5	10
6	8
7	7
8	6
9	6
10	5
15	3 and 4 cores from
~~20~~	every alternate bale
20	2 and 3 cores from
	every alternate bale

4. QUALITY OF REAGENTS

4.1 Unless otherwise specified, pure chemicals shall be used for the purpose of this test.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which effect the results of test.

5. REAGENTS

5.1 Scouring Solution

5.1.1 Standard Scouring Solution — containing 3 g of anhydrous sodium carbonate and one gram of neutral soap per litre of water (see Note).

OR

5.1.2 Except in case of dispute any of the commercially available wool-scouring solution of the soda-ash plus nonionic synthetic detergent type.

NOTE — Soft water having hardness not more than 60 parts per million should be used.

5.2 Neutral Alcohol — 95 percent.

5.3 Sodium Hydroxide Solution — 10 percent (w/v).

5.4 Dilute Acetic Acid — 0.1 percent (v/v).

6. APPARATUS

6.1 Tubs — minimum 4, each of at least 50 litres capacity.

6.2 Basket — made of copper or stainless steel with the bottom made of wire cloth of the kind prescribed to be used for 1.00-mm IS Sieve [see IS : 460-1962 Specification for Test Sieves (Revised)].

6.3 Wringer or Hydroextractor

6.4 Balance — capable of weighing to an accuracy of 0.5 g.

6.5 Drying Oven — ventilated type, capable of maintaining an inside temperature of $105^{\circ} \pm 2^{\circ}\text{C}$ and provided with a balance capable of weighing to an accuracy of 0.5 g; the balance shall have one of its pans in the form of wire-cage suspended within the oven.

6.6 Soxhlet Extractor

6.7 Muffle Furnace — capable of maintaining an inside temperature of $700^{\circ} \pm 20^{\circ}\text{C}$.

7. PROCEDURE

7.1 Take a sealed container. If its label indicates the original weight of the test specimen contained therein, take the test specimen out and note its original weight (W_1). If the label of the container does not indicate the weight of the specimen contained therein, weigh the sealed container, remove the test specimen out of it, re-weigh the container, and from the difference between the two weighings, determine the original weight (W_1) of the test specimen. Open out the specimen either by hand or by mechanical means and free it from impurities like dirt, dung, strings, etc, avoiding any loss of fibre and vegetable matter. Heat the scouring solution to $52^{\circ} \pm 5^{\circ}\text{C}$ and fill three tubs with it. Ratio of wool weight to volume of solution used for scouring bath shall be less than 15 g per litre. Agitate the specimen (enclosed in a 40 mesh net bag) in the basket for 3 to 5 minutes with hands. Use rubber gloves (alkali proof) for agitation. Remove the mesh bag with the specimen and squeeze between the rollers of wringers before it is passed on to the next tub. Treat the specimen (see Note) similarly in the second and third tub. Fill the fourth tub

with soft water and heat to $52^{\circ} \pm 5^{\circ}\text{C}$ and rinse the specimen in it. Remove the specimen and spray it with a strong stream of warm water so as to flush out, as much as possible, sand and other soil, pass the specimen through the rollers of wringers and centrifuge for five minutes to remove the excess of water. Dry the specimen in drying oven at $105^{\circ} \pm 2^{\circ}\text{C}$ to constant weight. Note the oven-dry weight (W_2) of the specimen accurately. Preserve the oven-dry specimen.

NOTE — After scouring in each bowl, recover the fibre lost during scouring by floatation and add the recovered fibres to the original sample before drying.

7.1.1 Repeat the procedure with the remaining specimens.

7.2 Determine the alcohol extractable matter content of the oven-dry scoured specimen by the following method.

7.2.1 Take about 10 g of scoured oven-dry specimen (see 7.1). Re-dry it in a drying oven at $105^{\circ} \pm 2^{\circ}\text{C}$, cool in a desiccator and weigh. Extract it with neutral alcohol in a Soxhlet extractor by heating on a water-bath for 20 extractions. Cool and disconnect the extraction flask. Recover bulk of the alcohol by distillation and evaporate the residue to dryness by drying it to constant weight in the drying oven at $105^{\circ} \pm 2^{\circ}\text{C}$.

NOTE — Owing to the slight volatility of certain constituents of the extract and to other causes, absolute constancy of weight is seldom attained. Prolonged heating is, therefore, undesirable. The weight may usually be regarded as constant if the loss between the two successive weighings taken at an interval of 30 minutes does not exceed 0.1 percent of the first of the two values.

7.2.2 Calculate the percentage of alcohol extractable matter content by the following formula:

$$X = \frac{100 a}{b}$$

where

X = alcohol extractable matter content, percent, by weight;

a = weight, in g, of the residue; and

b = weight, in g, of the oven-dry specimen taken.

7.3 Determine the ash content of scoured oven-dry specimen by the following method.

7.3.1 Take at least 5 g of scoured oven-dry specimen (see 7.1). Place it in a tared vitreous silica dish and re-dry it in a drying oven at $105^{\circ} \pm 2^{\circ}\text{C}$. Cool in a desiccator and weigh. Slowly ignite the specimen in the dish over a Bunsen burner till the specimen gets charred and ceases to produce volatile matter. Transfer the dish to a muffle furnace, maintained at $700^{\circ} \pm 20^{\circ}\text{C}$, ash the charred specimen and keep it within the furnace for one hour or more till it attains constant weight.

7.3.2 Calculate the percentage of ash content by the following formula:

$$Z = \frac{100 a}{b}$$

where

Z = ash content, percent, by weight;

a = weight, in g, of ash; and

b = weight, in g, of oven-dry specimen taken.

7.4 Determine the vegetable matter content of the oven-dry scoured specimen by the following method.

7.4.1 From each of the scoured oven-dry specimens (*see 7.1*) take approximately equal quantities of wool, so as to make about 40 g. Re-dry it in the drying oven at $105^{\circ} \pm 2^{\circ}\text{C}$ for such period till two consecutive weighings do not differ by more than 0.1 percent.

7.4.2 Take 400 ml of sodium hydroxide solution of 10 percent concentration in a beaker and bring it to the boil. Transfer the oven-dried wool to the beaker and boil for 3 minutes stirring the contents all the time. Allow to settle and decant through a 125-micron IS Sieve. Add 100 ml of cold water to the beaker and transfer the residue to the sieve. Wash the residue thoroughly with distilled water and rinse with dilute acetic acid to remove last traces of alkali. Wash finally with distilled water until the filtrate is neutral to litmus paper. Remove with the help of a tweezer, all vegetable fibres and tag material from the residue. Transfer the residue to a porcelain dish or crucible and dry it at $105^{\circ} \pm 2^{\circ}\text{C}$ for such period till two consecutive weighings do not differ by more than 0.1 percent.

7.4.3 Calculate the vegetable matter content, percent, in the sample by the following formula:

$$V = \frac{a \times F \times 100}{b}$$

where

V = vegetable matter content, percent, of the oven-dry scoured specimen;

a = oven-dry weight, in g, of the residue;

F = the correction factor taken to be equal to 1.1; and

b = oven-dry weight, in g, of the specimen (*see 7.4.1*).

7.5 Calculation

7.5.1 Calculate the clean wool fibre content of the sample by the following formula:

$$F = \frac{W_2 \times [100 - (X + Z + V)]}{0.842 W_1}$$

where

F = clean wool fibre content, percent, of the sample (see 2.1);

W_2 = oven-dry weight, in g, of the specimen after scouring (see 7.1);

X = alcohol extractable matter content, percent, of the scoured oven-dry specimen (see 7.2);

Z = ash content, percent, of the scoured oven-dry specimen (see 7.3);

V = vegetable matter content, percent, of the scoured oven-dry specimen (see 7.4); and

W_1 = original weight, in g, of the specimen (see 7.1).

7.5.2 Calculate the vegetable matter content, percent, in the sample by the following formula:

$$V_1 = \frac{W_2 \times V}{0.842 W_1}$$

where

V_1 = vegetable matter content, percent, in the sample adjusted to standard condition (see Note);

W_2 = oven-dry weight, in g, of the specimen after scouring (see 7.1);

V = vegetable matter content, percent, of the scoured oven-dry specimen (see 7.4);

W_1 = original weight, in g, of the specimen (see 7.1).

NOTE — The standard condition for wool shall be a moisture content of 13.8 percent, an alcohol extractable matter content of 1.5 percent, and an ash content of 0.5 percent.

7.5.3 Calculate the laboratory scoured yield of the sample by the following formula:

$$L = F + V_1$$

where

L = laboratory scoured yield, percent, of the sample (*see* 2.2);

F = clean wool fibre content, percent, of the sample (*see* 7.5.1);

V_1 = vegetable matter content, percent, in the sample adjusted to standard condition (*see* 7.5.2).

7.6 Calculate in a similar manner (*see* 7.5.1, 7.5.2 and 7.5.3) the clean wool fibre content, percent, and the laboratory scoured yield, percent, of the remaining test specimens. If the difference between any two of the three values for each characteristic exceeds 2.5 percent, draw fresh specimens in lieu thereof and test them. Calculate the respective mean of the values, separately for clean wool fibre content, percent, and laboratory scoured yield content.

7.7 Report the values obtained as in 7.6 and 7.5.2 as (a) clean wool fibre content, percent; (b) laboratory scoured yield, percent; and (c) vegetable matter content, percent, respectively of raw wool in the lot.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

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